

WHAT IS CLAIMED IS:

1. A method of fabricating a ceramic substrate with a thermal conductive plug of a multi-chip package; wherein the method comprises:

providing a plurality of green tapes:

5 forming a plurality of conductive openings and thermal conductive openings on the green tapes;

filling a metal paste into the conductive openings and the thermal conductive openings;

10 stacking the green tapes together, wherein the metal paste inside the conductive openings of every green tape is in contact with its neighboring metal paste within the conductive openings of the green tapes, the metal paste inside the thermal conductive openings of each green tape is in contact with each neighboring metal paste inside the thermal conductive openings;

15 cofiring those green tapes and the metal paste to form a pre-substrate, wherein the pre-substrate comprises an insulating structure, a plurality of thermal conductive plugs and conductive plugs, the insulating structure is formed by cofiring the green tapes so that a plurality of conductive plugs are formed due to the cofiring on the metal paste in the conductive openings and a plurality of thermal conductive plugs are also formed by cofiring the metal paste inside the thermal conductive openings, the pre-substrate further  
20 comprises a top surface and a bottom surface;

forming a first metal film on the top surface of the pre-substrate;

forming a second metal film on the bottom surface of the pre-substrate;

25 patterning the first metal film to form a plurality of die pads and conductive

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traces, the die pads in contacted with the thermal conductive plugs and the conductive traces in contacted with the conductive plugs;

adhering a plurality of chips on the die pads; and  
electrically connecting the chips to the conductive traces.

5 2. The method of claim 1, wherein a machine punching method is utilized to form the conductive openings and the thermal conductive openings on the green tapes.

3. The method of claim 1, wherein a stencil printing method is utilized to fill the metal paste into the conductive openings and the thermal conductive openings.

10 4. The method of claim 1, wherein a method of forming the first metal film comprises a sputtering deposition or an evaporation method.

5. The method of claim 1, wherein a method of forming the second metal film comprises a sputtering deposition or an evaporation method.

6. The method of claim 1, wherein the method further comprises a planarizing process after cofiring the green tapes and the metal-paste.

15 7. The method of claim 6, wherein the planarizing process is carried out to planarize the top surface of the pre-substrate by a polishing method.

8. The method of claim 6, wherein the planarizing process is carried out to planarize the bottom surface of the pre-substrate by a polishing method.

20 9. The method of claim 6, wherein a flat insulating layer is formed on the top surface of the pre-substrate during the planarizing process, and a plurality of openings are formed on the insulating layer to exposure the conductive plugs and the thermal conductive plugs,

10. The method of claim 6, wherein a flat insulating layer is formed on the bottom

surface of the pre-substrate during the planarizing process, and a plurality of openings are formed on the insulating layer to exposure the conductive plugs and the thermal conductive plugs.

11. The method of claim 1, wherein a maximum width of the thermal conductive opening is approximately between 20 milli-inches to 40 milli-inches.

12. The method of claim 1, wherein a photographic etching method is used to pattern the first metal film.

13. The method of claim 1, wherein pre-substrate further comprises a plurality of aligning-mark holes, which are formed into cavity-shaped holes and are used to align a mask layer to the pre-substrate.

14. The method of claim 13, wherein a fabricating method of the aligning-mark holes, comprising

forming a plurality of aligning hole on a predetermined number of green tapes while forming the conductive openings and the thermal conductive openings on the green tapes;

aligning the green tapes according to the aligning holes on the predetermined number of green tapes and stacking together with the green tapes without the aligning holes; and

forming the plurality of aligning-mark holes from the aligning holes after cofiring the green tapes and the metal paste.

15. A method of fabricating a ceramic substrate with a thermal conductive plug, comprising:

providing a plurality of green tapes;

forming at least a conductive opening and at least a thermal conductive opening on every green tape;

filling a metal paste into the conductive openings and the thermal conductive openings;

5 stacking the green tapes together, wherein the metal paste inside the conductive openings of every green tape is in contact with its neighboring metal paste within the conductive openings of the green tapes, the metal paste inside the thermal conductive openings of each green tape is in contact with each neighboring metal paste inside the thermal conductive openings;

10 cofiring those green tapes and the metal paste to form a pre-substrate, wherein the pre-substrate comprises an insulating structure, at least a thermal conductive plug and at least a conductive plug, the insulating structure is formed by cofiring the green tapes so that the conductive plug is formed by cofiring the metal paste in the conductive opening and the thermal conductive plug is formed by cofiring the metal paste inside the thermal  
15 conductive opening;

forming a metal film on the pre-substrate; and

patterning the first metal film to form at least a die pad and at least a conductive trace, the die pad in contacted with the thermal conductive plug and the conductive trace in contacted with the conductive plug.

20 16. The method of claim 15, wherein a machine punching method is utilized to form the conductive opening and the thermal conductive opening on every green tape.

17. The method of claim 15, wherein a stencil printing method is utilized to fill the metal paste into the conductive opening and the thermal conductive opening.

18. The method of claim 15, wherein a method of forming the metal film on the pre-substrate comprises a sputtering deposition or an evaporation method.

19. The method of claim 1, wherein the method further comprises a planarizing process after cofiring the green tapes and the metal paste.

5 20. The method of claim 19, wherein the planarizing process is carried out to planarize the pre-substrate by a polishing method.

21. The method of claim 19, wherein a flat insulating layer is formed on the pre-substrate during the planarizing process, and a plurality of openings are formed on the insulating layer to exposure the conductive plug and the thermal conductive plug.

10 22. The method of claim 15, wherein a maximum width of the thermal conductive opening is approximately between 20 milli-inches to 40 milli-inches.

23. The method of claim 15, wherein a photographic etching method is used to pattern the first metal film.

15 24. The method of claim 15, wherein pre-substrate further comprises at least an aligning-mark holes, which is formed into a cavity-shaped hole and is used to align a mask layer to the pre-substrate.

25. The method of claim 24, wherein a fabricating method of the aligning-mark hole, comprising

forming at least an aligning hole on at least a green tape while forming the  
20 conductive opening and the thermal conductive opening on the green tapes;

aligning the green tapes according to the aligning hole on the green tape and stacking together with at least another green tape without the aligning hole; and

forming the aligning-mark hole from the aligning holes after cofiring the green

tapes and the metal paste.

26. A method of fabricating a ceramic substrate with a thermal conductive plug, comprising:

- providing a plurality of green tapes;
- 5 forming at least a thermal conductive opening on green tapes;
- filling a metal paste into the thermal conductive opening;
- stacking the green tapes together, wherein the metal paste inside the thermal conductive opening of the green tapes is in contact with each neighboring metal paste inside the thermal conductive opening;
- 10 cofiring those green tapes and the metal paste to form a pre-substrate, wherein the pre-substrate comprises an insulating structure, at least a thermal conductive plug, the insulating structure is formed by cofiring the green tapes so that the thermal conductive plug is formed by cofiring the metal paste inside the thermal conductive opening;
- forming a metal film on the pre-substrate; and
- 15 ~~patterning the first metal film to form at least a die pad, and the die pad is in~~ contact with the thermal conductive plug.

27. The method of claim 26, wherein a machine punching method is utilized to form the thermal conductive opening on every green tape.

28. The method of claim 26, wherein a stencil printing method is utilized to fill the  
20 metal paste into the thermal conductive opening.

29. The method of claim 26, wherein a method of forming the metal film on the pre-substrate comprises a sputtering deposition or an evaporation method.

30. The method of claim 26, wherein the method further comprises a planarizing

process after cofiring the green tapes and the metal paste.

31. The method of claim 30, wherein the planarizing process is carried out to planarize the pre-substrate by a polishing method.

32. The method of claim 30, wherein a flat insulating layer is formed on the pre-substrate during the planarizing process, and at least an opening is formed on the insulating layer to exposure the thermal conductive plug.

33. The method of claim 26, wherein a maximum width of the thermal conductive opening is approximately between 20 milli-inches to 40 milli-inches.

34. The method of claim 26, wherein a photographic etching method is used to pattern the first metal film.

35. The method of claim 26, wherein pre-substrate further comprises at least an aligning-mark holes, which is formed into a cavity-shaped hole and is used to align a mask layer to the pre-substrate.

36. The method of claim 35, wherein a fabricating method of the aligning-mark hole, comprising

forming at least an aligning hole on at least a green tape while forming the thermal conductive opening on every green tape;

aligning and stacking the green tapes according to the aligning hole on the green tape and stacking together with at least another green tape without the aligning hole; and

forming the aligning-mark hole from the aligning hole after cofiring the green tapes and the metal paste.

37. A method of fabricating a ceramic substrate with a thermal conductive plug, comprising:

providing a plurality of green tapes;

forming at least a thermal conductive opening on green tapes, wherein a maximum width of the thermal conductive opening is approximately between 20 milli-inches to 40 milli-inches;

5 filling a metal paste into the thermal conductive opening;

stacking the green tapes together, wherein the metal paste inside the thermal conductive opening of the green tapes is in contact with each neighboring metal paste inside the thermal conductive opening; and

cofiring those green tapes and the metal paste

10 38. The method of claim 37, wherein a machine punching method is utilized to form the thermal conductive opening on every green tape.

39. The method of claim 37, wherein a stencil printing method is utilized to fill the metal paste into the thermal conductive opening.

15 40. A method of fabricating a ceramic substrate with a thermal conductive plug, comprising:

providing a plurality of green tapes;

forming at least a thermal conductive opening on green tapes;

filling a metal paste into the thermal conductive opening;

20 stacking the green tapes together, wherein the metal paste inside the thermal conductive opening of the green tapes is in contact with each neighboring metal paste inside the thermal conductive opening; and

cofiring those green tapes and the metal paste to form a pre-substrate, wherein the pre-substrate comprises an insulating structure, at least a thermal conductive plug, the



insulating structure is formed by cofiring the green tapes so that the thermal conductive plug is formed by cofiring the metal paste inside the thermal conductive opening.

41. The method of claim 40, wherein a machine punching method is utilized to form the thermal conductive opening on every green tape.

5 42. The method of claim 40, wherein a stencil printing method is utilized to fill the metal paste into the thermal conductive opening.

43. The method of claim 40, wherein a maximum width of the thermal conductive opening is approximately between 20 milli-inches to 40 milli-inches.

10 44. A method of fabricating a ceramic substrate with an aligning-mark hole, comprising:  
providing a plurality of green tapes;

forming at least an aligning hole on at least one of the green tapes,

aligning and stacking the green tapes according to the aligning hole on the green tape and stacking together with at least another green tape without the aligning hole; and

15 cofiring the green tapes to form a pre-substrate, wherein the pre-substrate  
comprises at least a pair of aligning-mark holes, and the aligning-mark holes are  
induced from at least a pair of aligning holes so that the aligning-mark holes are formed  
into a cavity-shaped.

45. The method of claim 44, wherein a machine punching method is utilized to form the aligning-mark holes on the green tape.

20 46. The method of claim 44, wherein a maximum diameter of the aligning-mark holes is  
approximately between 10 milli-inches to 25 milli-inches.

47. A method of fabricating a ceramic substrate with an aligning-mark hole, comprising:  
providing a plurality of green tapes;

forming a plurality of aligning holes on a predetermined number of the green tapes,

aligning and stacking the green tapes according to the aligning holes on the green tapes and stacking together with at least another green tape without the aligning  
5 hole; and

cofiring the green tapes to form a pre-substrate, wherein the pre-substrate comprises a plurality of aligning-mark holes, and the aligning-mark holes are induced from a plurality of aligning holes so that the aligning-mark holes are not drilled through and formed into a cavity-shaped.

10 48. The method of claim 47, wherein a machine punching method is utilized to form the aligning-mark holes on the green tape.

49. The method of claim 47, wherein a maximum diameter of the aligning-mark holes is approximately between 10 milli-inches to 25 milli-inches.

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